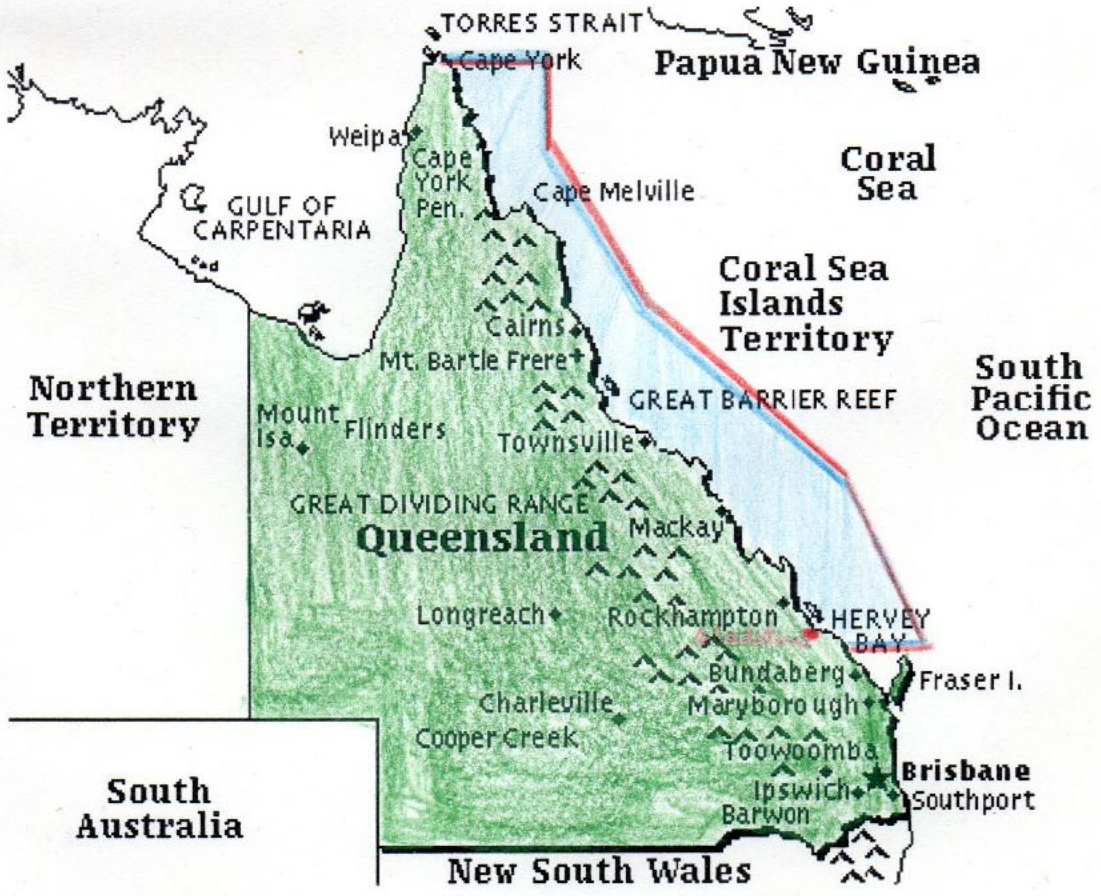
FORM 8 GEOGRAPHY ASSIGNMENT

The Great Barrier Reef



by Hugh Chaffey-Millar

October 1994

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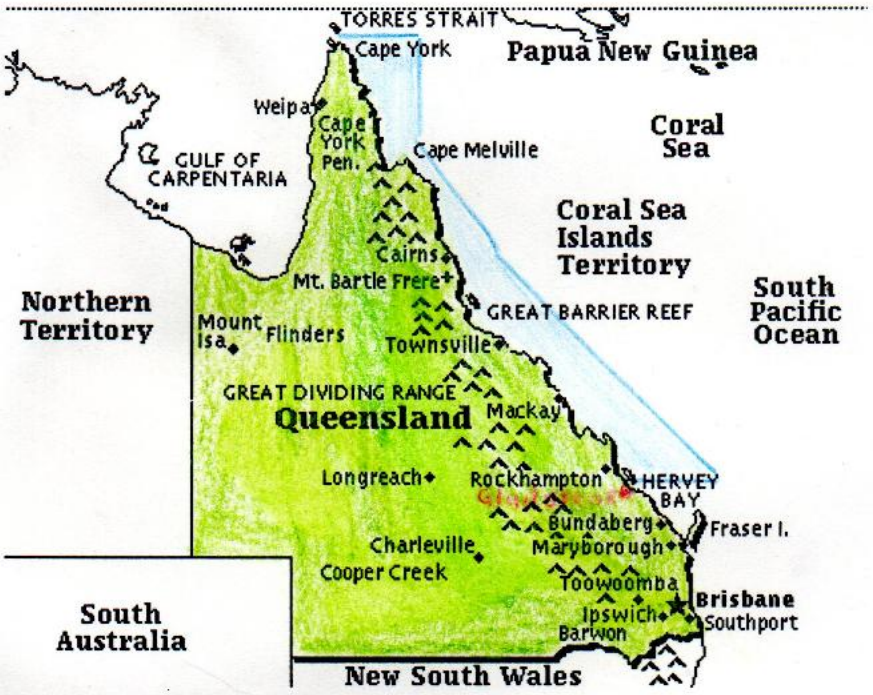
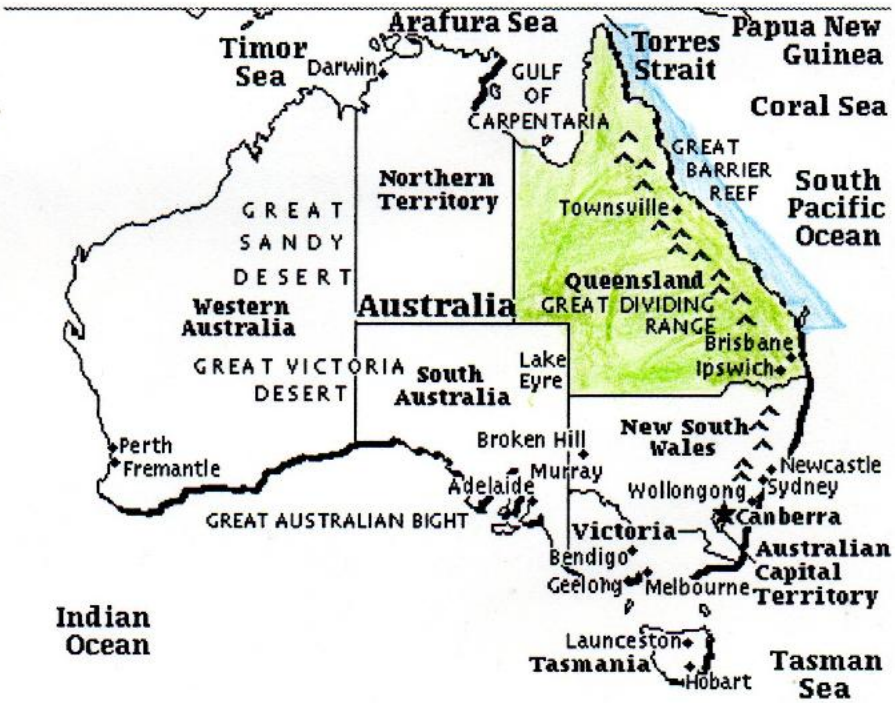
= Great Barrier Reef Marine Park

Location:



The Great Barrier Reef is located on the north-east coast of Australia. It stretches north and north-west from Gladstone, Queensland to an area in the Gulf of Papua opposite Port Moresby, Papua New Guinea.

Top: Close up of Great Barrier Reef off the coast of Queensland.
Right: Map of Australia Showing Queensland and Great Barrier Reef.

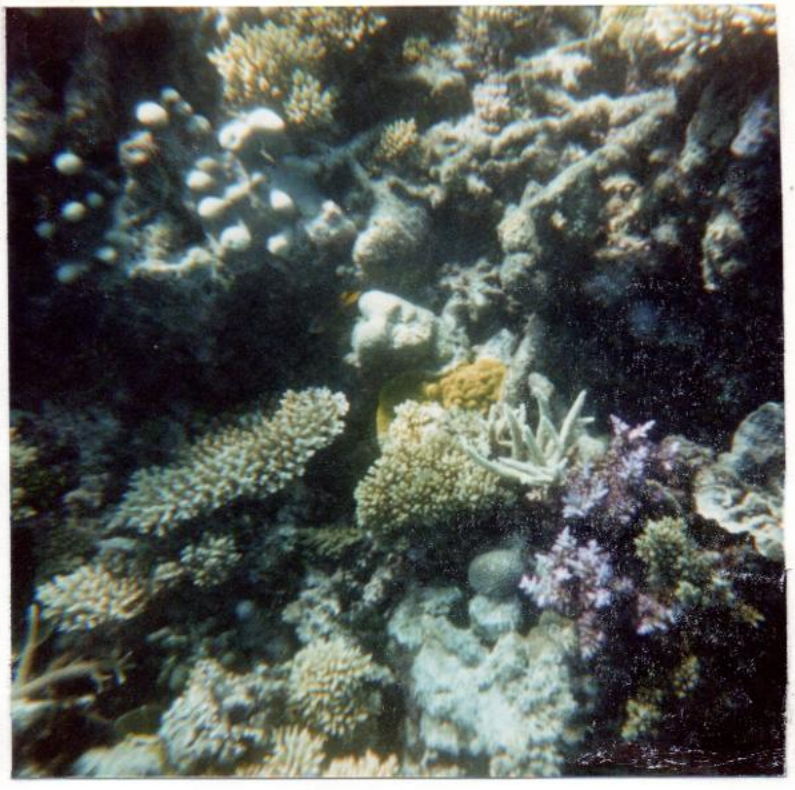


BRA Q 187 1992

COMPILED from information obtained from various larger scale maps.
PROJECTION: Simple conic with two standard parallels 15°S and 20°S.

Description:

What it is Like:



Typical landscape of the Great Barrier Reef

The Great Barrier Reef is the largest group of reefs in the world. It is not a continuous barrier but a scattering of thousands of smaller reefs.

The Great Barrier Reef has been placed on the World Heritage list written by UNESCO (United Nations Educational, Scientific and Cultural Organisation) because of its incredible size and number of plants and fish. A warm climate, colourful wildlife, sandy beaches and tropical islands make the Great Barrier Reef an extremely popular tourist attraction.

How it was formed:

Scientists suggest that some of the sections of the Great Barrier Reef are up to 18 million years old, but most of the structures that can be seen today have developed during the last 2 million years. The uppermost layers of reefs which are at sea level are only a few thousand years old. However, most of the reefs are built upon lots of other older reefs.

Sea level was very close to its present level about 125,000 years ago. This allowed reefs to develop on Australia's continental shelf. Sea level was about 130 metres below today's level about 20,000 years ago, at a time when most of the Earth's water was ice. At this time, most of Australia's continental shelf was exposed as a coastal plain. The reefs at this time were limestone hills rising from the plain. About 18000 years ago, the hills were covered by water as the sea level rose again. This allowed coral to begin to grow again in the new, warm, shallow water; the old reefs providing an ideal foundation for this new growth.

As Australia's coastal plain was covered by the rising sea, quite a few high mountain ranges became rocky, continental islands as they were cut off from the mainland. A lot of these continental islands have reefs around them and attract the majority of reef tourism.

East Hope Island (Vegetated Coral Cay).

The smaller islands known as "coral cays" are different from the continental islands as they are rarely more than a few metres high and a hectare in area. These tiny islands are structurally part of the reef. Cays are a deposit of shingle, sand or rubble piled together by wind, waves and tidal currents on top of often extensive reef tops. This material comes largely from the decomposition of shells, coral and sometimes algae. Eventually this build up of dead remains becomes suitable for plants to grow on them. First, beach plants grow and then eventually a dense forest can develop. In the Great Barrier Reef region there are 205 cays with little or no vegetation and 65 with coral and plants.

Prominent Coral Cays

Name	Vegetated?	Location (closest town)
Wheeler Cay	No	Townsville
East Hope Island	Yes	Port Douglas
Lady Musgrave Island	yes	Cairns
Pipon Reef	Yes	Cairns
Lindeman (Group)	Yes	Proserpine
Whitsunday (Group)	Most	Proserpine
Pandora Reef Rubble and Sand Cay	Yes	Tully (North of Townsville)
Green Island	Yes	Cairns

Climate:

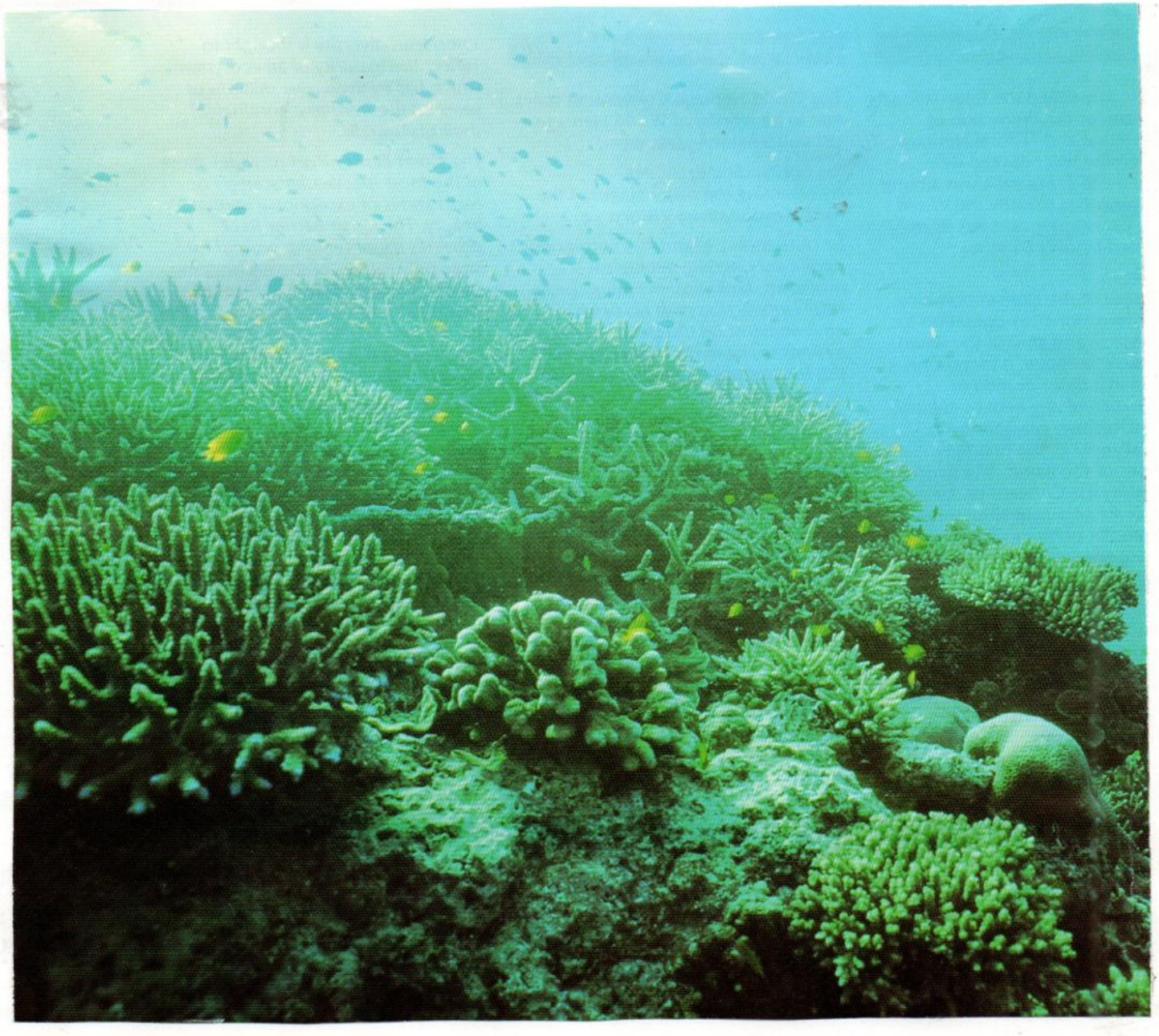
The Climate of the Great Barrier Reef varies greatly from the North to the South. The North has tropical conditions and high humidity with a wet season at about January. The South has cooler, subtropical to temperate conditions. The water temperature at the South of the Great Barrier Reef rarely falls below 20° C, the surface water temperature ranging from 20° C to 38° C.

Marine Life:

An Example of Soft Coral

There are two types of coral: soft and hard. Both types are made up of coral polyps and coralline algae but the soft coral has fleshy tissue between them whereas hard coral has

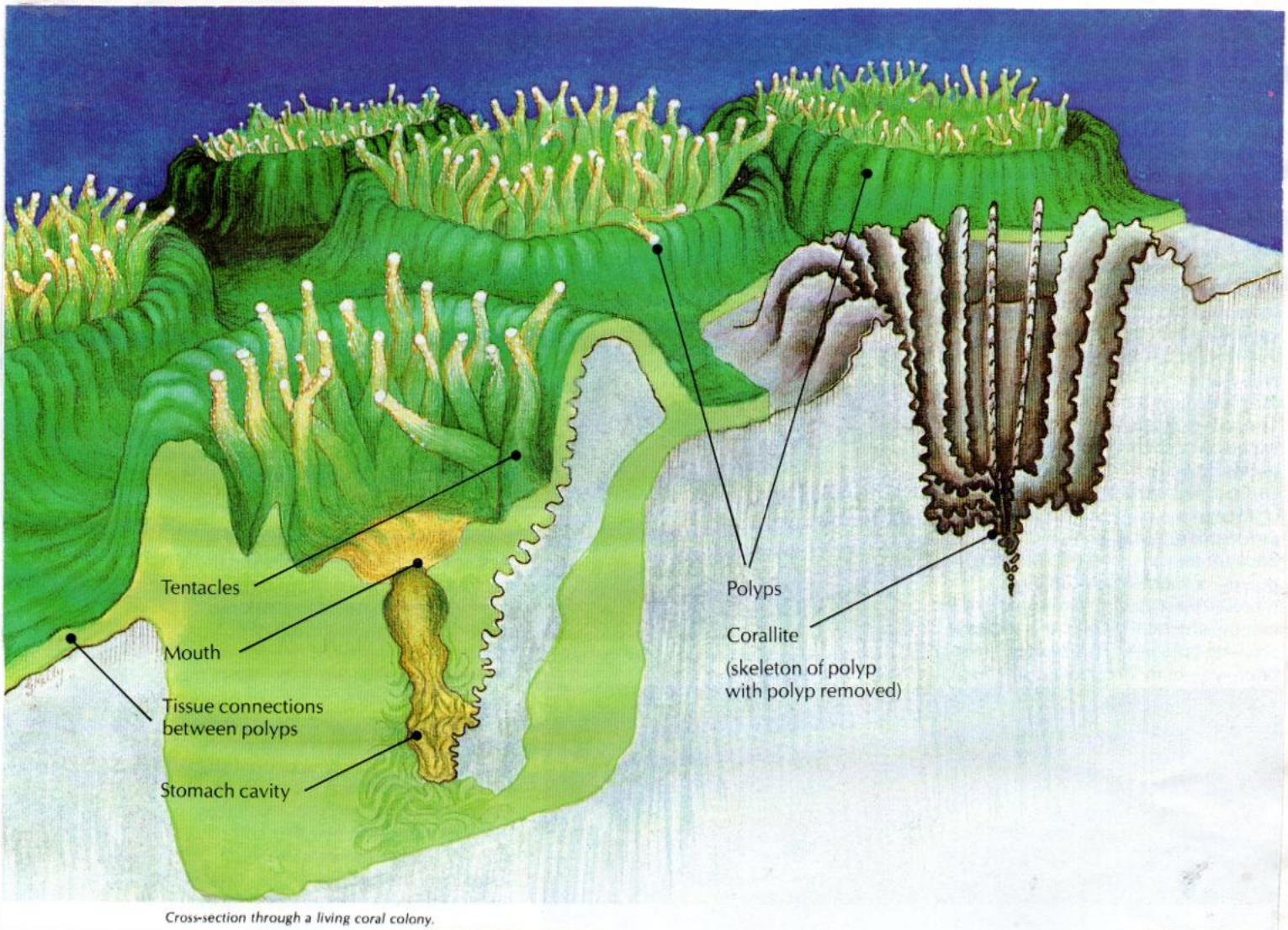
limestone between them. As coral dies and the skeletons of coralline algae go hard limestone binds both types of coral together. This forms a secure base for more coral to grow on top. When this carries on for thousands of years, the reef can grow to many metres in thickness with a thin layer of living coral on the outside.



An example of Hard Coral

The coral polyps that build reefs grow best where there is plenty of sunlight and fairly still waters. The water needs to be well aerated and have a good supply of nutrients. These conditions are usually found from the mid-tide level down to about 40 metres. Some corals grow in waters up to 120 metres deep, however these are not important reef builders.

A coral reef has many species of corals, some of these species are Staghorn coral, Brain coral, Honeycomb coral and Mound coral. The colour of coral comes from pigments in the tissues of the polyps. When coral dies, only its white limestone skeleton stays behind.



Cross-section through a living coral colony.

The success of coral as a reef builder is partly due to the tiny, single celled plants called zooxanthellae, which live in the cells of the polyp's tissue. Zooxanthellae, like other plants,

photosynthesise, but these plants are slightly different as they use the carbon dioxide produced by the coral polyps and in turn give some of the food they have produced to the polyps. This speeds up the rate at which the polyps produce their limestone skeleton.

Parrot Fish

Coral Reefs have more types of fish than any other water environment on earth. There are approximately 3,000 types of fish in oceans round the world, the Great Barrier Reef has over 1,500 of these. Angel fish, Cod, Manta Rays, Butterfly fish, Parot fish and Surgeon fish all live and breed in the area. Three species of marine turtles live in the area: the Green, Hawksbill and Loggerhead are found in reef waters. They breed on the beaches of cays. Out of the 10,000 species of shellfish that are found world wide, 4,000 can be found on or near the Great Barrier Reef. Other animals that live in the reef area include crabs, shrimps, crayfish, sea urchins, sea stars, sea cucumbers, soft corals, sea fans, sponges sea anemones and worms.

Left: Common Reef Fish

Problems the Reef Faces and What is Being Done About Them

The Problems:

#1. Tourism: The Great Barrier Reef is one of the most popular holiday destinations in Australia. Countless boats take hundreds of tourists on trips to the outer reef, islands and cays. Coral under large tourist pontoons is also at risk as they block out sunlight which is required for coral growth. Chemicals from sun block creams are also a threat to the coral.

Reckless tourists destroying reef.

#2. Too many nutrients in water: Run-off from farmland and sugar cane growing areas contains high levels of nutrients from fertilizers and the sugar from the sugar cane its self. This runs into the sea and makes the amount of nutrients in the water too high, causing some types of algae to thrive. This algae kills the coral by growing on top of it and blocking out all sunlight. Too many nutrients can also increase the amount of Phytoplankton which the Crown-of- Thorns starfish feeds on.

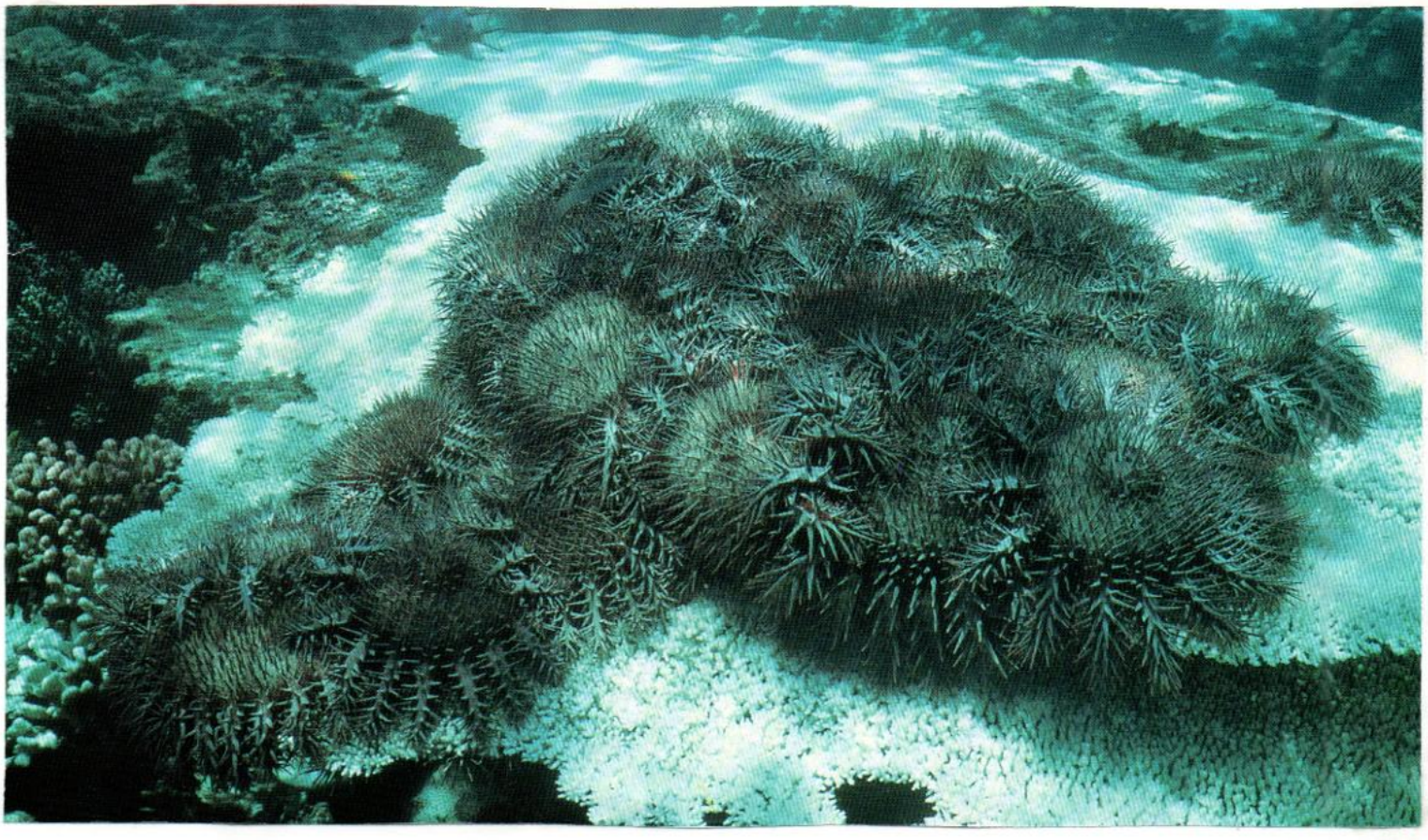
#3. Coral Bleaching: This is another consequence of the Greenhouse Effect. If the temperature rises too high, coral starts to discard the tiny algae which gives it colour.

#4. Dumping of oil and Garbage: Some ships dump oil and garbage. With only one ranger per 5200^2 km of reef this is hard to stop.

#5. Fishing: The catching of reef fish is becoming less successful as fish numbers decline.

#6. Other: Anti-fouling paints on the bottom of boats and anchor fins both help to decline the quality of the reef.

#7. Crown-of-Thorns Starfish *(Acanthaster planci)*: These starfish are a multi-armed Echinoderm (Phyla/Group of animal Kingdom) which feeds on the living parts of corals. A Crown-of-Thorns starfish eats coral polyps by pushing its stomach out of its mouth (a process called stomach eversion). The stomach then secretes digestive juices onto the coral, breaking down the polyp's tissue. One adult starfish can destroy 50 years of coral growth in one night. Once one starfish starts to eat, a chemical is released which attracts other starfish to the feeding site.



An "Aggregation" of Crown-of-Thorns Starfish.

The Solutions:

#1. Tourism: Tourist boats which take lots of tourists from the shore to the reef are not allowed to change their mooring once they have chosen it. Therefore it is in the owner's best interests to look after the site as otherwise they will go out of business. Tourists are also briefed (on most trips to the reef) about how to maintain the reef's wildlife when swimming and snorkelling.

#2. Too Many Nutrients in Water: Farmers are encouraged not to over- water crops. They are also encouraged not to have farms too close to the shore.

#3. Coral Bleaching: People all around the world are constantly being warned about the Greenhouse Effect and how to look after the environment.

#4. Dumping of Oil and Garbage: The GBRMPA (Great Barrier Reef Marine Park Authority) is the organization in charge of looking after the reef. There is talk at the moment of increasing the numbers of rangers patrolling the reef.

#5. Fishing: Laws are about to be introduced so that fish under a certain length must be thrown back. This will ensure that young fish will have a chance to grow up and reproduce.

#6. Other: Research is in progress to try and find an organic anti-fouling paint for the bottom of ships. Moorings could be used instead of anchors so that the anchor does not drag along destroying coral.

#7. Crown-of-Thorns Starfish: There is still no definite answer to the problem with the crown-of-thorns starfish. Research is constantly going on. Some ideas are to find the starfish's natural predators. Some scientists argue that the starfish (which is also common in other reefs) is a natural part of the reef Ecosystem, they say that the killing of the coral provides an opportunity for different species of coral to exist where previously living coral was beforehand.

Interviews

Marine Biologist on the Quicksilver Reef Boat:

Question: Is the Great Barrier Reef under threat at the moment?

Answer: No, in fact this reef is quite a healthy one.

Question: Are there any precautions taken to keep the reef in good shape?

Answer: Yes, the GBRMPA which stands for the Great Barrier Reef Marine Park Authority has been set up to try and minimise threats to he reef.

Crew member from the Chinese Junk Tourist Boat:

Question: Is the Great Barrier Reef under Threat at the moment?

Answer: The Great Barrier Reef is constantly under threat by a species called human beings.

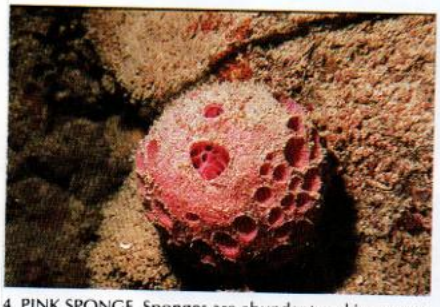
Question: Are there any organisations or groups which specialise in keeping the reef in good shape?

Answer: The GBRMPA which stands for the Great Barrier Reef Marine Park Authority is an organization which has extensive monitoring programs to try and keep the reef as healthy as possible.

1. CALCAREOUS ALGAE This green seaweed, which is abundant in lagoons and sandy reef slopes, secretes a calcium carbonate skeleton. When it dies, the skeleton crumbles adding to the sand around reefs.

2. TURTLE WEED This green alga grows in clumps up to about 100 mm high. Here it is growing on *Porites* coral. Despite its name, it is not often eaten by turtles or fish as it contains toxic terpene chemicals.

3. STINGING HYDROID A colonial relative of th jellyfish and corals, its feeding individuals (polyp have many stinging cells for capturing prey and f defence. A brush with this hydroid can be painful, lik brushing a stinging nettle, but not deadly.



4. PINK SPONGE Sponges are abundant and important members of the reef community. They sieve tiny animals and plants (plankton), mucus and other waste products from the water, retaining energy in the community. Many sponges also farm plants (zooxanthellae).

5. COMPOUND SEA SQUIRT The sea squirts are also abundant in the reef community. They resemble sponges as adults but, when young, they look more like fish. Like clams, corals and many sponges, they contain symbiotic algae. They also feed by filtering plankton.

6. CHRISTMAS TREE WORMS These brilliantl coloured tubeworms live in the massive corals particularly the intertidal microatolls. The coral grow around their tubes, giving them added protection Only their spiral gills are exposed to obtain oxyger and floating food.

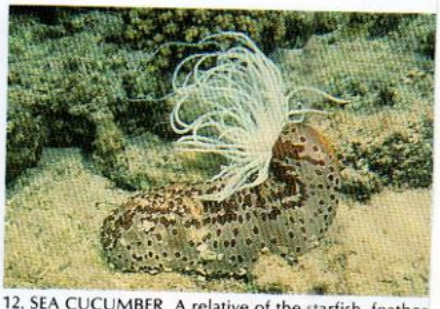
7. HERMIT CRAB Crustaceans on the reef may be extremely vulnerable to predators. Many emerge at night only or live in association with corals or other animals. The hermit crab protects its soft abdomen with a borrowed snail shell.

8. TEXTILE CONE SHELL This mollusc (marine snail), shown here with its eggs, has a venomous sting for capturing its prey (other molluscs). Some cone shells are dangerous to humans and all should be handled only with great caution.

9. SPIDER SHELL This active mollusc has been turned over to show its two eyes and the muscular foot ending in a claw which is used for protection and for stability. It inhabits shallow lagoons, feeding on algae.

10. SEA SLUG Called a nudibranch, this shell-less mollusc has naked gills on the back of its body. Many nudibranchs are brilliantly coloured and distinctively patterned such as this one which has just laid a bright yellow collar containing thousands of eggs.

11. GIANT CLAM This gigantic bivalve (two-shelled) mollusc is aided in its spectacular growth by the garden of microscopic plants within its fleshy mantle. The largest giant clam grows to over 1 metre long and may weigh hundreds of kilograms.



12. SEA CUCUMBER A relative of the starfish, feather stars and sea urchins, the sea cucumber lies on its side ingesting organic matter from the sand and reef surfaces. Some emit sticky white threads as a defence mechanism when disturbed.

13. FEATHER STAR This relative of the starfish and sea urchins spreads its arms to catch floating plankton which is then passed along the arms to the mouth.

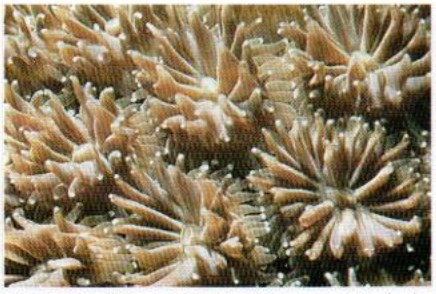
14. BLUE STARFISH Usually lives on reef tops where it feeds on microorganisms and other food fragments on the reef surface.

15. CROWN OF THORNS STARFISH A large starfish with about 16 arms, it feeds on living coral tissue, leaving only the skeleton behind. Sometimes occurs in great numbers causing much damage to reefs. The reasons for the outbreaks are not known.

16. FIRE CORAL This hydrozoan is a closer relative of the jellyfish than of the true corals. Its polyps are specialised for different functions such as feeding or defence and can give a sting to a human skin.

17. GORGONIANS Related to the soft corals, the gorgonians or sea fans have a horny skeleton. They are found in deeper water usually in areas of high current.

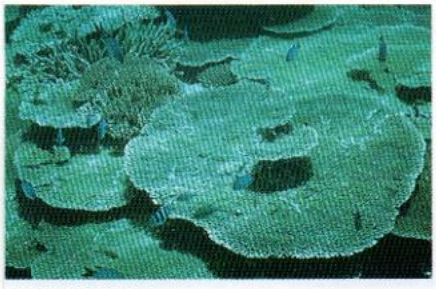
18. SOFT CORALS Soft corals lack the rigid calcareous skeleton of the reef-building hard corals. With its polyps expanded, the colony on the left has a feathery appearance. With polyps withdrawn into its rubbery matrix, the colony on the right appears smooth.



19. HARD CORAL POLYPS The coral animal, the polyp, is a soft bag with a mouth and stomach surrounded by a ring of stinging tentacles, all held in a limestone cup. It feeds on plankton but obtains most of its food from plants (zooxanthellae) housed in its tissues.

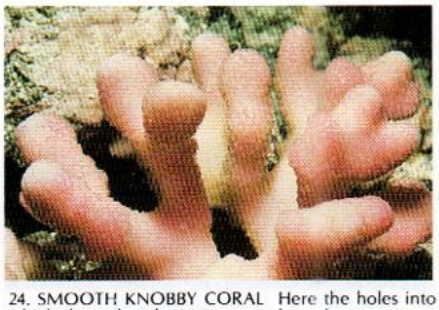
20. BRANCHING STAGHORNS These delicate corals are found in lagoons where wave action is minimised. They are fast growing and provide important shelter for reef fish.

21. STAGHORN CORAL This is the only coral form to have a single polyp on the tip of each branch. Colony sizes range from a few centimetres to several metres across and, in some areas, thickets of staghorn coral extend over hectares.



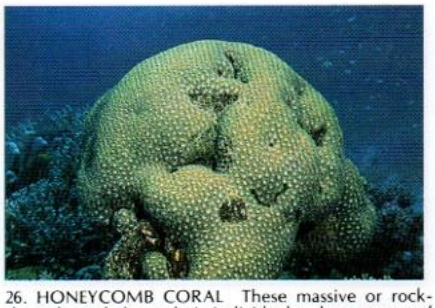
22. PLATE CORAL A close relative of the staghorns, plate coral is made up of many short branches all joined at the base.

23. NEEDLE CORAL Thin fragile branches are constructed by hundreds of small polyps. They protude at night from the tiny holes which can be seen on each branch.

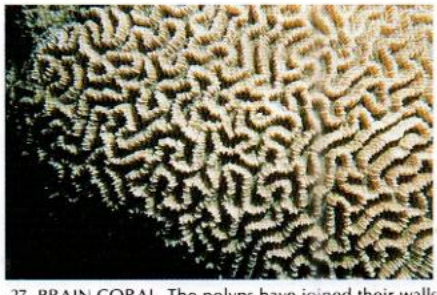


24. SMOOTH KNOBBY CORAL Here the holes into which the polyps have contracted can be seen more easily. The coral skeleton consists of limestone, extracted chemically from sea water by the polyps with the aid of their plant partners.

25. LEAF CORAL In deep water where there is less light, corals tend to flatten out and become delicate leafy shapes.

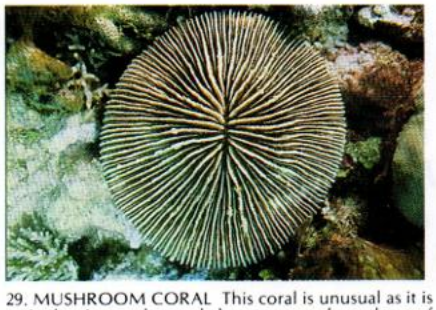


26. HONEYCOMB CORAL These massive or rock-shaped corals have their individual polyps separated by circular walls, but all polyps interconnect by a thin layer of tissue.



27. BRAIN CORAL The polyps have joined their walls together to form ridges and the valleys contain a row of polyp mouths.

28. ENCRUSTING CORAL Encrusting forms of several hard corals exist. They compete well for space and light growing over neighbouring corals and other sedentary organisms.



29. MUSHROOM CORAL This coral is unusual as it is a single giant polyp and does not attach to the reef floor. The tentacles expand at night.

30. MUSHROOM CORAL This second type of mushroom coral has very long tentacles which remain extended day and night.

31. BLUE PULLERS These abundant and conspicuous damselfish are plankton feeders and hover close to stands of staghorn corals. When threatened, they pull into the coral for cover. (Grow up to 110 mm long)

32. ANEMONE FISH This specialised damselfish gains protection from and is immune to, the paralysing anemone tentacles among which it swims freely. (Grows to 140 mm)

33. BUTTERFLY FISH Colourful, flat and deep-bodied fish usually found in pairs. They feed on small crustaceans, algae, and/or coral polyps. (The largest of the butterfly fish reaches 300 mm. Several species grow only to about half that length.)

34. TRUMPET FISH Long, slender fish with a distended trumpet-like mouth used to seize small fish. A habit of swimming just above a coral trout to give the image of one large fish, helps it sneak up on its prey. (Grows to 750 mm or more.)

35. PARROT FISH Brightly coloured, heavy-bodied fish with beak-like jaws used to break off algae and coral. The sound of parrot fish crunching can often be heard, particularly on the reef flat at high tide. They swim distinctively, using only their pectoral fins. (Common species grow to between 350 mm and 1 metre)

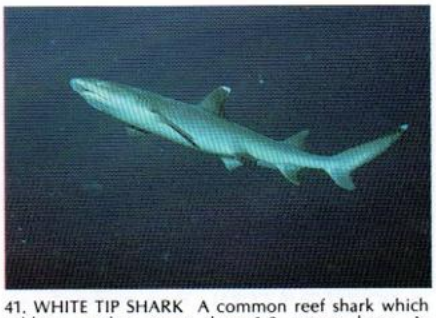
36. CORAL TROUT Large predatory fish related to the gropers and rockcods. Commonly feeds on small schooling fish and is a highly esteemed table fish. (Six species found on the Reef grow to between 500 mm and 1 metre)

37. SWEETLIP A large, deep-bodied, and often conspicuously-coloured fish with extremely thick and fleshy lips. Feeds on shelled animals and worms vacuumed from the sand. (The largest of the sweetlips grows to about 900 mm)

38. ANGEL FISH This brightly-coloured, disc-shaped grazer usually lives in pairs. Other smaller angel fish live in groups with one male and a harem of females. (This species grows to 380 mm)

39. CLEANER FISHES Small, striped, cigar-shaped fishes which clean dead tissues and parasites from the skin, mouth and gills of other fish — here a damselfish. Large fish suspend their predatory impulses for this cleaning treatment! (Grow to 100 mm)

40. LAGOON RAY This cartilaginous fish feeds on molluscs and crustaceans in the sand. Often partially buried in the sand, its two venomous tail barbs pose a threat to beach fossickers. (Commonly has a disk about 300 mm in diameter and a total length of 900 mm, but known to reach a length of 2.4 m)



41. WHITE TIP SHARK A common reef shark which seldom reaches more than 1-2 metres long. As scavengers, they are normally harmless to humans.

42. GREEN TURTLE A marine reptile which forages for algae and sea grasses. The female comes onto sandy coral cays to lay her eggs at night.

Bibliography

1. World Book 1990 Edition, World Book Inc.

2. Various Brochures from the Great Barrier Reef Marine Park Authority.

3. Quantum, ABC Television Programme, 12 October 1994

4. Australian Geographic "Mass spawning on the Great Barrier Reef" Number 32, Oct-Dec 1993.

5. "Beautiful One Day, Wiped out The Next", The Bulletin, September 13, 1994

6. Microsoft Encarta 1994

7. Encyclopaedia Britannica, 1992 Edition

8. Various Photographs and Knowledge Gained on the reef by the Writer.

GEOGRAPHY ASSIGNMENT - FORM 7-10

Name: Hugh Chaffey Millar

Topic: The Great Barrier Reef.

	MARK
PRESENTATION	5/5
CONTENT	5/5
ANALYSIS	4/5
REFERENCES/RESEARCH/MAPS	5/5
TOTAL	19/20

Additional Comments:

A very good assignment Hugh.
Your information is descriptive & supported with appropriate diagrams & photos.
You have not really mentioned the future (as asked for).

Overall, an excellent assignment.